Mine Water Treatment System
Technical Proposal

PREPARED FOR

Matt Francis
Environmental Restoration LLC
4870 Newport Street
Commerce City, CO 80022

PREPARED BY

Evoqua Water Technologies
August 17, 2015

Curtis J. Wood
General Industry Sales Engineer
Tel: (303) 378-7253
Email: curtis.wood@evoqua.com

Ben Buchsieb
Environmental Services Sales Engineer
Tel: (480) 299-8612
Email: bennett.buchsieb@evoqua.com

August 14, 2015

Matt Francis
Environmental Restoration LLC
4870 Newport Street
Commerce City, CO 80022

Dear Mr. Francis,

Evoqua Water Technologies is pleased to present the following technical proposal to you for treating the drainage from the Gold King Mine in San Juan County, Colorado.

Evoqua, with our beginnings in 1953 as US Filter, and our recent history as Siemens Water Technologies, is the leading water treatment company in the United States. Whether servicing potable, industrial process, or waste water, our unique products and industry-leading service capabilities make us uniquely suited to partner with you for this critical project.

The system we are proposing will be simple yet effective at meeting your end goals. Using proprietary technologies such as mobile ACTIFLO® clarification and SCU™ metals removal media, our approach with provide excellent results in a compact, flexible footprint. Our system will also be fully turnkey as Evoqua employees will be onsite for system installation, start up, operation and maintenance. Additionally, we are already prepared to begin moving assets for this project. We have Evoqua-employed service technicians currently stationed less than three hours away from the site, and other support personnel in Denver, Phoenix and Salt Lake City prepared to assist in having this system up and running in a matter of days.

Based on our conversations, we have included options for system redundancy to ensure ongoing operation of our system.

We understand the critical nature of this project and we are ready to mobilize our assets and personnel as soon as directed. We welcome the opportunity to discuss this Technical Proposal with you in further detail. We will adjust our schedules to meet with you face-to-face or via conference call at your convenience.

Best Regards,

Curtis J. Wood

PROCESS DESCRIPTION

1.0 CAUSTIC ADDITION AND AERATION

The proposed treatment process begins with air mixing and injection of sodium hydroxide to raise pH to 7 to 7.5. This will cause several reactions to occur:

- Precipitation of aluminum
- Precipitation of iron as iron hydroxide
- Co-precipitation of arsenic (V) with the iron hydroxide
- Some manganese may precipitate
- The hardness, copper, zinc and cadmium will remain mostly soluble at this pH and pass through the clarification process for later treatment if required.
- TSS after precipitation is estimate to be in the range of 400-500 mg/liter based on data provided

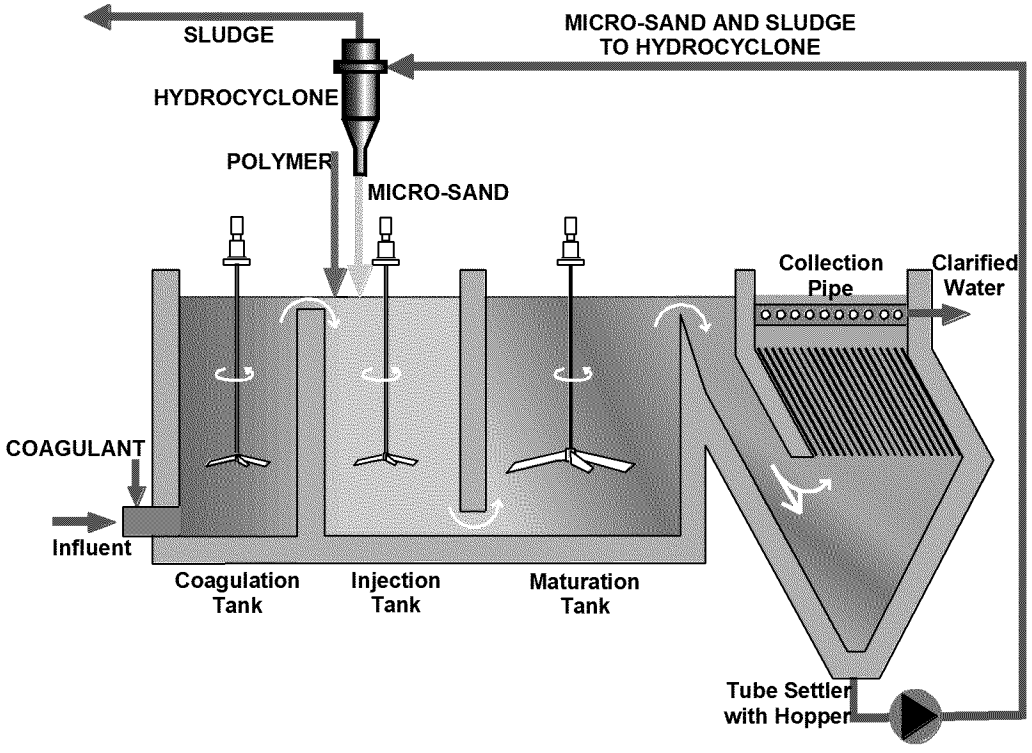
Caustic injection and reaction will occur in a mix/aeration tank of 18,000 gallon capacity allowing for 15+ minutes of reaction time. Treated water will gravity flow to clarification.

2.0 ACTIFLO® MOBILE CLARIFICATION

The ACTIFLO® process is a compact high performance water clarification system that combines the advantages of microsand enhanced flocculation with lamella tube settling. The addition of microsand serves as a flocculation aid and ballasting agent, allowing overflow rates as high as 30 gpm/ft^2 in water treatment applications. These high overflow rates result in system footprints that are between 5 and 25 times smaller than conventional clarification systems of similar capacity. ACTIFLO® treatment is accomplished through a series of consecutive process steps that consist of coagulation, microsand and polymer injection (injection), floc maturation (maturation), settling and sand recirculation. A graphical presentation of the ACTIFLO® process is provided below.

Each ACTIFLO® trailer is hydraulically rated for flow rates of up to 1000 gpm. Final flow rate will be determined based on water chemistry, and treatment needs.

ACTIFLO® Process Flow Diagram



2.1 Coagulation, Injection and Maturation Tanks

Chemical coagulant (alum, ferric, etc.) and possibly pH adjustment chemicals (such as acid or caustic) are added into the raw water piping prior to entering the coagulation tank. The raw water then enters the coagulation tank. Coagulant destabilizes the suspended solids and the colloidal matter in the influent stream. Efficient mixing is provided in the coagulation tank. This mixing thoroughly disperses the coagulant and the destabilized particles into the raw water over a hydraulic retention time of approximately two minutes. The destabilized particles collide and begin early stage floc formation.

The coagulated water then flows over a weir into the injection tank where flocculant aid polymer (polymer) and microsand are added to initiate floc formation. Here, the combination of flash mixing and a hydraulic retention time of approximately two minutes allow for thorough incorporation of microsand and polymer into the coagulated water. The combination of microsand and polymer serve as a "seed" for floc formation and development in the next process step.

ACTIFLO® treatment continues as water passes through the underflow passage from the injection tank into the maturation tank. Although chemical floc formation actually begins with the addition of polymer and microsand in the injection tank, the majority of ballasted floc formation occurs during the maturation process step. Gentle mixing and increased hydraulic retention time of approximately six minutes provide ideal conditions for the formation of polymer bridges between the microsand and the destabilized suspended solids. The large specific surface area of the microsand that provides enhanced opportunity for polymer bridging and enmeshment of microsand and floc already in suspension further augment this process.

2.2 Settling Tank

The fully formed ballasted floc leaves the maturation tank and enters the settling tank. Here the ballasted flocs rapidly settle and are removed from the treated water via lamella settling. Laminar upflow through the lamella-settling zone provides rapid and effective removal of the microsand/sludge floc. Clarified water exits the ACTIFLO® system via a series of weirs and collection troughs for subsequent filtration.

2.3 Sand Recirculation System

The ballasted floc-sand-sludge mixture is collected at the bottom of the settling tank and withdrawn using a rubber-lined centrifugal slurry pump. The sand-sludge mixture is then pumped to the hydrocyclones for separation. Energy from pumping is effectively converted to centrifugal forces within the body of the hydrocyclone causing chemical sludge to be separated from the higher density microsand. Once separated, the microsand is concentrated and discharged from the bottom of the hydrocyclone and re-injected into the ACTIFLO® process for re-use. The lighter density sludge is discharged out of the top of the hydrocyclone and sent for thickening or final disposal.

2.4 Sludge Handling

The light sludge is collected and thickened in an 18,000 gallon weir tank and transferred to customer for disposal by an air operated diaphragm pump. Sludge enters the process at about 1% solids and leaves at 2-4% solids. Decant water is pumped back to the feed of the system for recovery.

3.0 EQUALIZATION & BAG FILTRATION

An equalization tank is provided to stabilize flow and allow transfer pumps to provide water under pressure to bag filters. Bag filters are needed to remove any carry-over from the clarification process and to protect SCU media downstream.

4.0 SCU™ MEDIA FOR DISSOLVED CATIONIC HEAVY METAL REDUCTION

Following bag filtration, tanks of SCU™ media are used for cationic metal removal. SCU™ is a proprietary granular carbonaceous adsorbent supplied in service exchange vessels for adsorption of transition metals from industrial wastewater, ground water and storm runoff water. SCU selectively adsorbs dissolved metal cations including cadmium (Cd), trivalent chromium (Cr^{+3}), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni), and zinc (Zn) while allowing calcium (Ca) and magnesium (Mg) to pass through.

Two stages of treatment will be used, with a lead tank removing the bulk of the dissolved metals and a lag tank polishing the effluent. Using lead / lag vessels allows running the lead tank to the leakage point of some metals, which provides maximum capacity before the tank is replaced, while ensuring metal removal continues. Exhausted media is returned to Evoqua's Roseville, Minnesota facility for recovery of metals and disposal of the spent media.

5.0 ASG™ MEDIA FOR ARSENIC POLISHING

If the co-precipitation of arsenic with existing iron in the ACTIFLO® system does not result in meeting the arsenic discharge goal, an additional media step can be used. ASG™ (a titanium-based adsorptive media) can also be employed using separate pressure vessels or layered within the vessels supplied for the ASG™ media, also in a lead / lag configuration.

6.0 EQUIPMENT SCOPE

The proposed system includes the following equipment for each train (**double quantities for two trains**):

- One (1) portable eyewash. A 15 gallon pressurized vessel with standard eyewash connection and wash-down hose is included.
- One (1) inlet flow control station. A flow meter is used to monitor inlet flow. The flow meter also provides signals for control of chemical injection systems.
- One (1) sodium hydroxide feed system. 25% sodium hydroxide will be injected upstream of the aeration/mix tank. Dose is estimated at 100-400 ppm on a 100% basis. Feed system includes AOD pump and pH monitor.
- One (1) mixing tank. An 18,000 gallon steel storage "frac" tank for mixing and aeration. This tank includes 3 or 4 electric mixers to keep solids suspended. Product water overflows to the mobile clarifier. A separate air blower with diffuser system provides fine bubble aeration to assist in oxidation of the iron. To accomplish gravity flow, the bottom of the mix tank will need to be placed 15+ feet above the bottom of the clarifier. If not, a transfer pump will be needed.
- One (1) Mobile Actiflo® Clarification Trailers. The Actiflo clarification system uses a sand-ballasted flocculation in order to clarify raw water at flow rates up to 1000 gpm in a single trailer. The Actiflo trailer is fully automated and includes a lab area with chemical (acid, caustic, or hypochlorite), and coagulant metering pumps, and polymer make-up and dosing systems. On-board coagulation, injection, and maturation tanks ensure adequate contact time with the chemicals and recirculated sludge and sand. A lamellar tube clarification section improves sludge separation from the effluent water. The Actiflo produces a continuous 20-25 gpm of sludge waste, at a concentration of 0.1-1%
- One (1) clarified water storage tank. An 18,000 gallon steel "frac" storage tank. This tank receives clarified water overflow from the mobile clarifier and includes a level transmitter.
- One (1) transfer pumps. (1) on-line. Each pump is capable of delivering 600 gpm at 55 psig and is powered by a diesel engine. Diesel provided by customer. A level control line with proportional valve will be used to circulate water back to the mix tank.
- One (1) bag filter housing. Rated for up to 1000 gpm flow. Inlet and outlet pressure gauges will allow the operator to check solids accumulation via differential pressure across the filters.
- Two (2) SCU™ Vessels. Treatment vessels are lined carbon steel tanks skid mounted in pairs. Each vessel is rated for 75 psig at 105°F and has a 10' diameter. Each vessel is loaded with 13,370 pounds of SCU™ media over a carbon media under-bed.

- Two (2) ASG™ Vessels (optional). Treatment vessels are lined carbon steel tanks skid mounted in pairs. Each vessel is rated for 75 psig at 105°F and has a 10' diameter. Each vessel is loaded with TBD pounds of ASG™ media over a carbon media under-bed.
- One (1) Solids tank. An 18,000 gallon steel "frac" tanks is provided with weirs to concentrate solids from the mobile clarifier. The last chamber of this tank contains clean water that will be circulated back to the system feed.

7.0 REDUNDANCY

Understanding the critical nature of this project, Evoqua can provide two redundant trains of the equipment described above to allow for switching between either system in case of any down time. This would ensure continued treatment should any unexpected failure occur to the primary train.

An option to a fully redundant system would be to have onsite storage of critical spare parts that may require replacement during the project. Items such as pumps, mixers, valves, etc. could be maintained and replaced as necessary by Evoqua's onsite technicians. The effectiveness of this option would depend on the amount of time provided by the volume of the holding ponds and the associated flow rate from the mine.

8.0 SUPPORT

Evoqua currently has trained, experienced service technicians (Evoqua employees) within a couple of hours of Durango, Colorado ready to assist with this project. We have additional service support at our Evoqua service centers in Denver, Phoenix and Salt Lake City that can also be called on to support this project.

Evoqua staff will provide start up and support of this project including full operation of the system, sampling and onsite analysis, system modifications and repair, and any necessary reporting.

9.0 RESPONSE TIME

Evoqua looks forward to discussing this technical proposal with Environmental Restoration and/or USEPA at your soonest convenience. We can meet face-to-face or via teleconference as works best for you.

Once you provide documentation indicating you need us to assist with this project, Evoqua is prepared to begin moving assets. We will also mobilize our service staff to be onsite to coordinate receipt of the equipment and begin immediate installation and startup of the system